CT Water Turbine

An Energy Saving Equipment Used in Cooling Tower

Cooling Tower Water Turbine (CTWT)

Cooling Water Circulation System

Circulation water pump is like human heart, drives circulating water with a certain pressure and flow rate into various equipment distributed in different systems.

various heat exchangers or central air-conditioning condensers

Cooling tower lowers the temperature of circulating water.

Cooling water pump

(output =667.56m^3/hr)
Cooling water pump

(output =667.56m^3/hr)
Cooling water pump

(output =667.56m^3/hr)

Air compression system (circulating water needs=34.00m^3/hr)

Air compression system (circulating water needs=28.78m^3/hr)

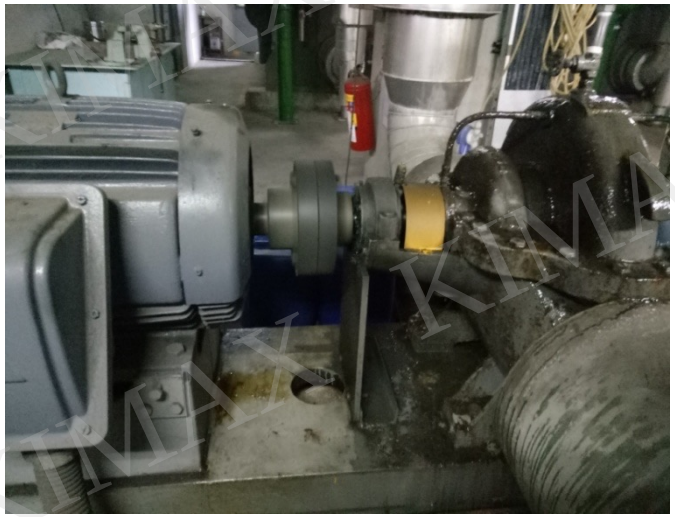
Air compression system (circulating water needs=31.28m^3/hr)

1000 RT water chiller (circulating water needs=727.28m^3/hr)

500 RT water chiller (circulating water needs=282.01m^3/hr)

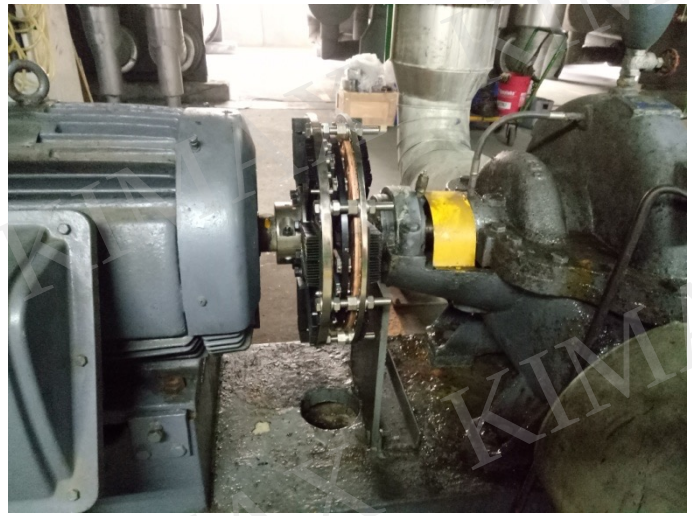
Cooling Water Circulation System

Main energy saving approaches and electricity consuming equipment in cooling water circulation system



Motor of circulating water pump
Energy saving approach

Permanent Magnetic Coupling



Driving motor of cooling water tower
Energy saving approach

CT Water Turbine

Principle of Cooling Tower Water Turbine

Cooling Tower Water Turbine (CT Water Turbine)

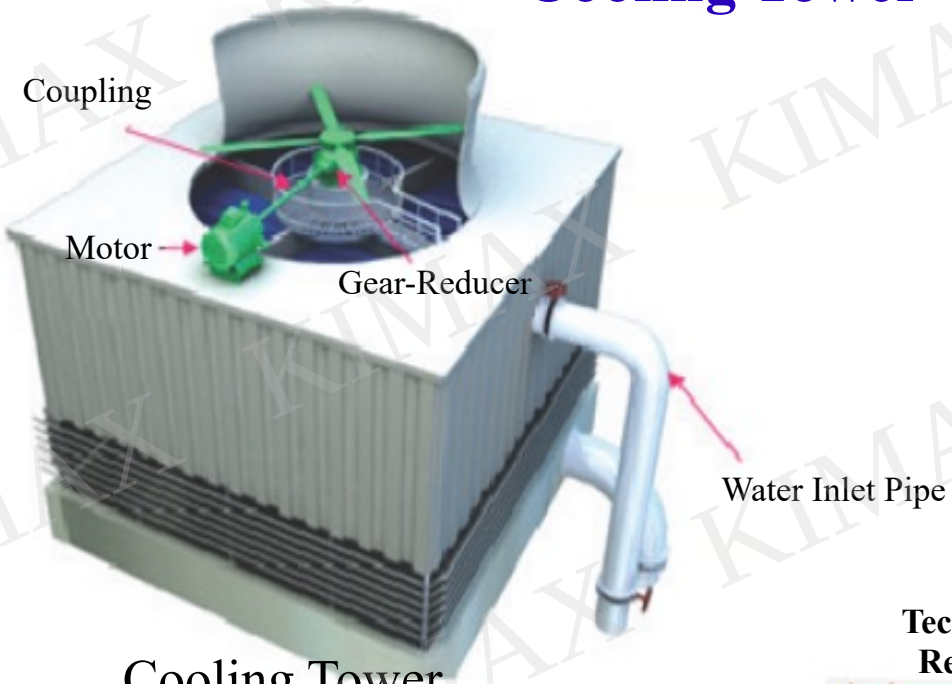
Water turbine transforms water flow pressure into rotation mechanical power which principle is widely used in water power generation.

Water turbine specially designed for cooling water tower can save energy by using surplus pressure within circulation system to drive water turbine, and thereby replacing the traditional electric motor.

The special water turbine with low flow and low lift for water circulation system developed from KIMAX, then the purpose of lowering cost, saving energy and emission reduction can be achieved.

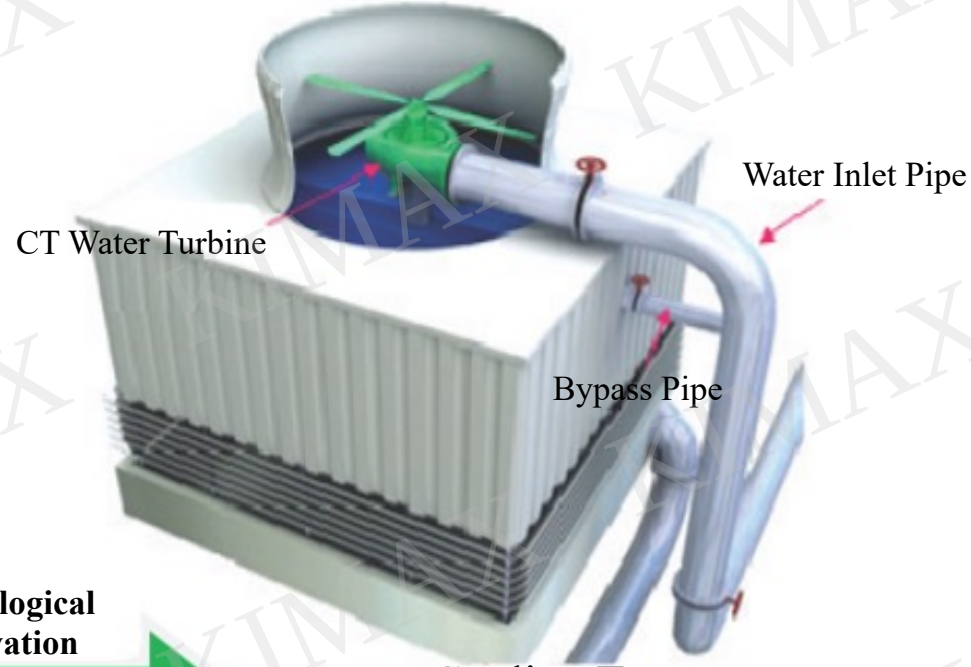
Principle of Cooling Tower -Water Turbine

Cooling Tower -Water Turbine (CT Water Turbine)



Cooling Tower
(gear reducer + coupling + motor)

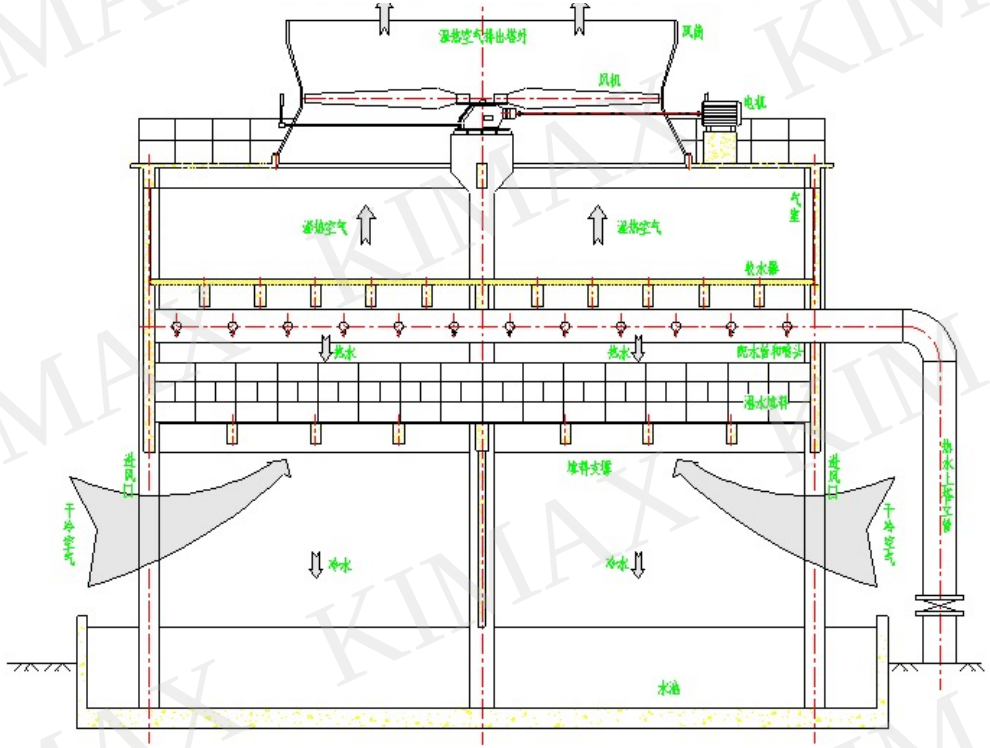
Technological Renovation



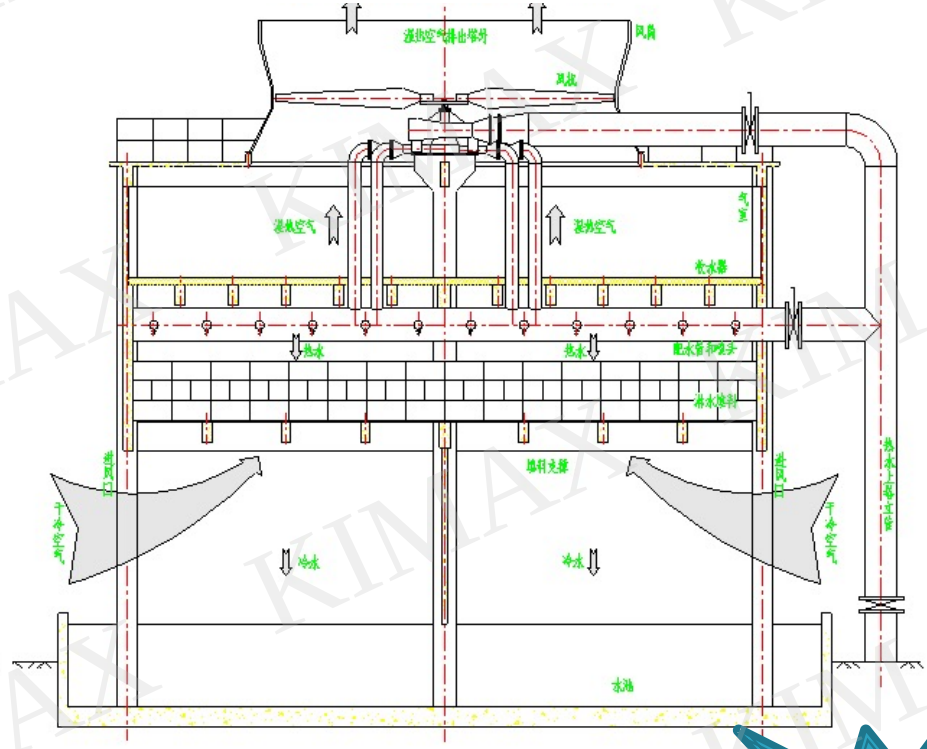
Cooling Tower
(CT Water Turbine)

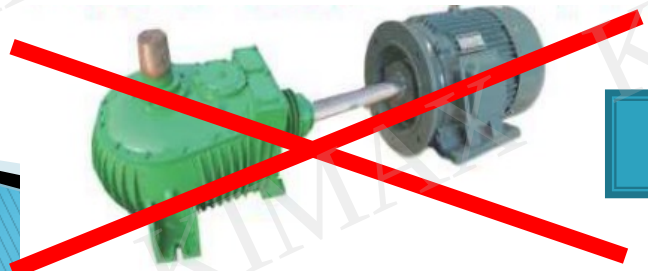
Principle of Cooling Tower -Water Turbine

Traditional Cooling Tower



KIMAX Cooling Tower Water Turbine





replace

SAVE 100%

Research and Development Background

CT Water Turbine with more or less 6-year history has been widely recognized in terms of 100% electricity saving in energy saving field. However, since the driving force of CT Water Turbine is from circulating water pump pressure, CT Water Turbine's failure is often limited or fails by insufficient pressure in the early years. (far less than original fan rotation speed and poor heat radiation effect in summer)

The CT Water Turbine has greatly been improved its own efficiency, upgraded compensation for insufficient pressure, increased equipment reliability to make its technology renovation stepping into a mature progress.

1:Directly-through->cross-flow-> High speed ratio ->Low speed ratio (Power assisted booster)

2. 2D blades ->3D blades

3. Technological improvement of bearing, seal & lubrication

4. Flow pipe optimization or compensation

Different Types of CT Water Turbine

Directly-through (1st type): It is used for cooling tower is externally installed. Its CT Water Turbine is out of cooling tower's chimney, with the original transmission mechanism being kept (transmission shaft and reduction box). CT Water Turbine uses water to work, and drives fan through transmission mechanism.

Problems:
1. Needs high head pressure.
2. Only replaces motor, lower efficiency
3. Large vibration
4. Still needs a lot of maintenance

Cross-flow (2nd type): One of impulse turbines, whose working principle is circulating flows into water inlet and shocks blades at 90° angle, and crosses transitional surface of blade to the opposite blade for the second shock, after which, flows out from the side to complete the whole work.

Problems:
1. Main axis of blade endures unbalanced force radially, easily causing shaft bearing wear, vibration and noise.
2. Water flow easily forms vortex in shell, causing resistance and influencing efficiency of CT Water Turbine

Different Types of CT Water Turbine

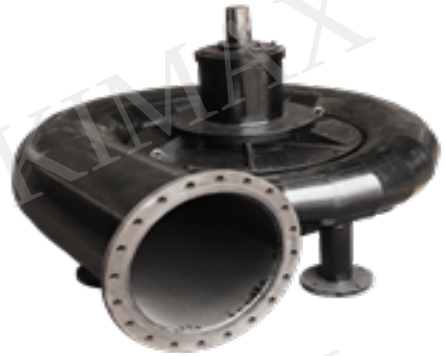
High speed ratio (3rd type): Similar to the hydroelectric turbine structure, high speed need to install the gear box to slow down.



Problems:

1. Large entire height, it is needed to lower original reducer gear box's base position or elevate original chimney's height, therefore, air extraction effect of fan will be greatly lowered.
2. Needs very high head pressure.
3. Gearbox installed will increase vibration, lower transmission efficiency and result in higher fault rate.

＊Low speed ratio (4th type) : Circulating water first flows into flow runner outside of the CT Water Turbine, and evenly distributed by flow guides, shocks rotation blades with even pressure, the impulse points are evenly distributed in a 360° circle. After impulse, water flows out of water outlet and completes work process.

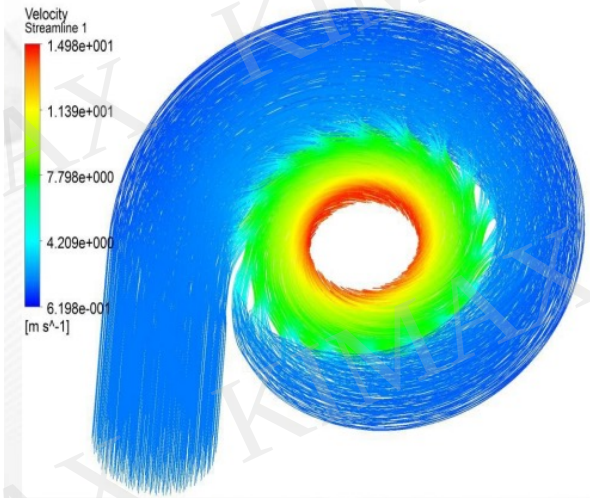



Problem:

1. Structure design, runner design, processing technologies are demanding than other these for CT Water Turbines.

Evolutionary Process of CT Water Turbine (Kimax CT Water Turbine is 4th type)

Kimax CT Water Turbine belongs to generation 4 CT Water Turbine, and also the optimal type in the market. Its design is based on cooling system parameter, surplus pressure and flow requirements from users, and relevant technical parameters of each structural part of obtained after analysis. In design and production phases, flow areas, guide angles, rotation wheel diameters and blade shapes of various nodes are specifically designed and processed based on these analysis. Therefore, each CT Water Turbine is tailored to customer needs and can best meet user process and user requirements.



Performance Advantages:

1. Head pressure needed by Kimax CT-water pressure is at least 15% less than other similar CT Water Turbine manufactured by other suppliers. For example, Kimax 5000T CT Water Turbine actually needs 8m head while these from others at least need 15m. This is enough to enable Kimax CT Water Turbine's efficiency and onsite working conditions for renovation. These are much better than other similar CT Water Turbines.
2. 2. Since the design of Kimax CT Water Turbine is based on user's working conditions, flow and flow rates at different guide points are basically the same, shocking force borne by the whole CT Water Turbine shell is even, radial and axial forces applied to points on main shaft are the same, so the main shaft mainly bears axial load from fan. In this way, CT Water Turbine can run stably with little vibration and vibration speed is between 1.0-2.5mm/s

Operation Process to Renovate CT Water Turbine

- A. Stop the cooling tower, turn off water and power when it is being renovated;
- B. Keep original framework structure during renovation, dismantle reducer, transmission shaft, motor, adjust reducer ‘s base height;
- C. Adjust pipe delivering water to tower so that circulating water first passes CT Water Turbine, then flows into water distribution system;
- D. Change water inlet pipe into bypass pipe whose bypass value controls the starting and shutdown of fan, or controls fan rotation speed based on environmental changes;
- E. Make supports under water inlet and outlet pipes and CT Water Turbine, make an opening on air duct and reinforce the opening;
- F. Preservation treatment of pipelines and other steel parts under construction.
- G. Start the machine for commissioning, begin pilot running, then complete test and acceptance.

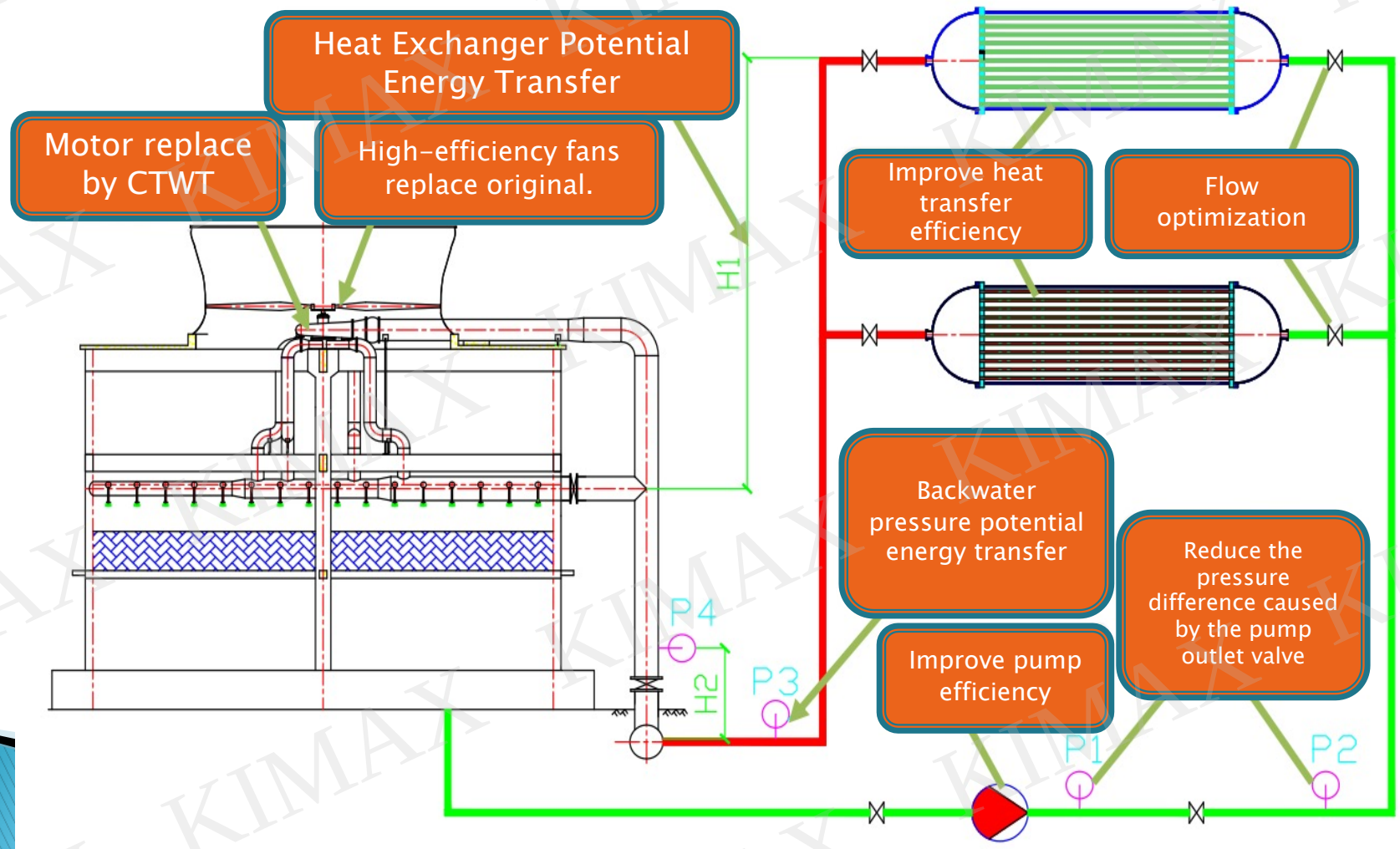
Acceptance of Renovated CT Water Turbine

The General Acceptance Indexes for Renovated CT Water Turbine

1. After renovation, circulating water pump's running current remains unchanged (ensure comprehensive energy saving index);
2. After renovation, fan blade's rotation speed remains the same as design standards before renovation (ensure cooling index during running) ;
3. After renovation, running vibration index should be better than before (ensure safety index during running).

Actually, the most important factor for renovating CT Water Turbine used for cooling water is water temperature rather than fan speed. If this point is accepted, the CT Water Turbine could be renovated together with smart system, with which, fan speed could be adjusted to the optimal status (energy saving and water saving) according to temperature changes.

Power source-surplus energy distribution map



Renovation Case

Jinxi Steel & Iron Co., Ltd

Project Name: Renovation of CT Water Turbines for 6×800m3 Cooling Tower for Circulating Water System in Waste Heat Generation

Project Introduction:
The original CT Water Turbine completed by one company in Anhui, only showed a rotation speed of 130-150 rpm during pilot running period, less than rating speed of 210 rpm, and increased water pressure by 0.11 MPa which caused water flow to be decreased by nearly 1000 m³/h. This working condition cannot meet system running requirement and was not accepted . In June of the same year, this project was renovated by Kimax CT Water Turbine . After completion, system has run for consecutive 12 months, with satisfactory results.

Replaced original CT Water Turbine

Acceptance Conclusion:
The originally built cooling tower in Anhui, China showed a CT Water Turbine which speeds at130r/min when water supply pressure was 0.47MPa and water flow per tower was 800m³/h, and was not accepted due to not meeting running requirement.
Over the renovation by Kimax, water pressure supply was decreased to 0.36Mpa. Under the prerequisite of water flow per tower was 800m³/h, rotation speed became 210r/min, meeting design requirement. After two months consecutive running, this renovation project was accepted.

Renovation Case

Nanjing X Clean Energy Co., Ltd

Project Name: Renovation of #2 5000m³/h Cooling Tower for Circulating Water System Phase 2

Project Introduction:

Phase 2 Circulating Water System 1# 5000m³/h cooling tower was renovated for energy saving by an Anhui Company in 2012. After completion, under the condition that returning water pressure was 0.39MPa, the actual water flow was 4500m³/h(flow loss was about 1000m³/h), fan speed was 95r/min, which could not meet working requirement in summer, and did not reach acceptance standard. This project was renovated again by Kimax in 2014.

Acceptance Conclusion:

Newly renovated project data includes: water supply pressure 0.42MPa, water returning pressure 0.39MPa which were the same as before. When water flow was 4500m³/h, fan's rotation speed reached 117r/min (rating speed 117r/min). This fully met running requirements and passed acceptance.

Renovation Case

Zhenjiang Chemical X Engineering Company

Project Name: Renovation of 4× 4500m³ Cooling Tower Used CT Water Turbines For Energy Saving

Project Introduction:

The #1 cooling tower of public project's circulating water system was renovated for energy saving. Renovated tower passed summer running assessment, fully meeting design conditions and technological requirements. Again, the other four towers of the same system were renovated in 2014.The total renovated capacity reached 22500m³/h.

Acceptance Conclusion:

#1 Cooling tower renovation was completed in April 2012, the practically measured data in June 15, 2012 were: water returning pressure was 0.27MPa, flow per tower was 4500m³/h, and fan's rotation speed reached 109r/min, temperature decrease (inlet 26.1℃ , outlet 32.2 ℃) was 6.1 ℃, meeting technological requirements. The renovation of #1 tower was accepted. The whole project was completed at the end of 2013 and accepted in May 2014.

Renovation Case

Jilin Chemical Co., Ltd

Project Name: Renovation of CT Water Turbines for 2×5000m³ Cooling Towers of Phase 1 Circulating Water System

Project Introduction:
#1 and #3 cooling towers of phase 1 circulating water system were renovated for energy saving. After renovation, the two towers completely met design conditions and technological requirements. During renovation, current system's water returning pressure was used. After renovation, system's water returning pressure and water supply pressure remained unchanged. Total renovation capacity was 5000m³/h.

Acceptance Conclusion:
Renovation of cooling towers was completed in May 2014, data measured in that period were: water returning pressure 0.24MPa, flow per tower 2500m³/h, fan's rotation speed 155r/min, temperature decrease (inlet 26℃, outlet 32 ℃) 6℃, which met with technological requirements. This project was accepted.

Renovation Process

Before Renovation

Renovation Case

Yanchang Chemical Co., Ltd

Project Name: Renovation of CT Water Turbines for 4× 2500m³ Cooling Towers of Circulating Water System

Project Introduction:
#1, #2, #5 and #6 cooling towers of circulating water system were renovated for energy saving. After renovation, the cooling towers fully met with design conditions and technological requirements. . During renovation, current system's water returning pressure was used. After renovation, system's water returning pressure and water supply pressure remained unchanged. Total renovation capacity was 10000m³/h.

Acceptance Conclusion:
Cooling tower renovation was completed in September 2013 and data measured in that period showed: water returning pressure was 0.24MPa, water flow per tower was 2500m³/h, and fan's rotation speed was 53r/min, temperature decrease also met technological requirement. This project was accepted.

Renovation Case

Shaanxi Chemical Co., Ltd

Project Name: Renovation of CT Water Turbines for 18× 4000m³/h Cooling Towers of Circulating System.

Project Introduction:
10 out of 11×4000m³/h cooling towers in circulating system A and 8 out of 10×4000m³/h cooling towers in circulating system B were renovated.

Acceptance Conclusion:
After renovation, parameters for system A and B were measured as follows: Water flow for each tower was between 3850m³/h--4050m³/h; CT Water Turbine's inlet pressure was between 7--7.8mH_2O, vibration was between 2.6--2.9mm/s, which all complied with (except for a few ones) parameter standards before renovation. This project was accepted by parts in April 2015 and July 2015, respectively.

Field Cases

Nanjing subway station:
Renovation of 9× 200m³/h cooling towers to the CT Water Turbine

Nanjing Feicui Jinlun Square:
Renovation of 6× 200m³/h cooling towers to the CT Water Turbine

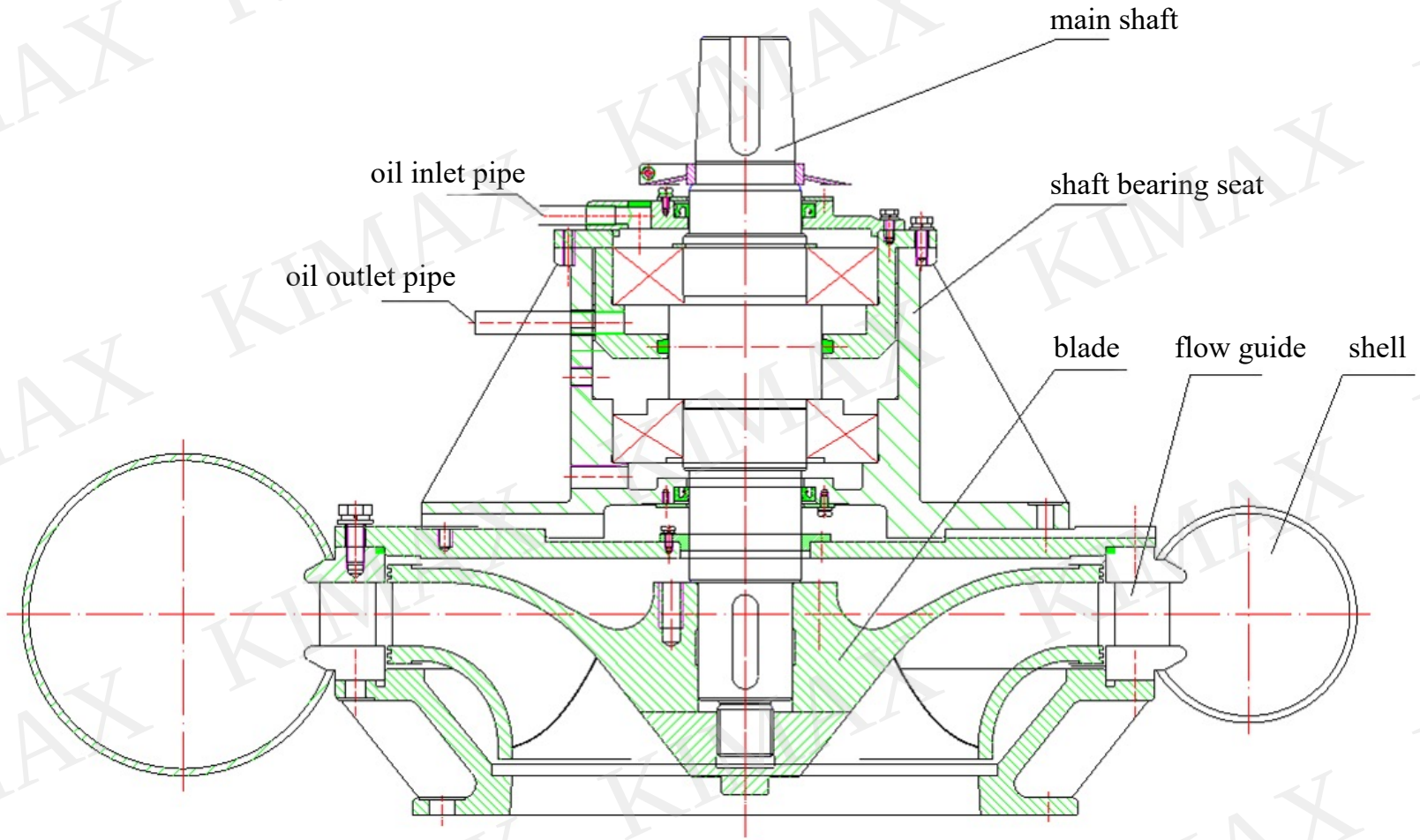
Tangshan Zhongrun Group :
Renovation of 2× 2500m³/h cooling towers to the CT Water Turbine

Shandong Fenghuang Energy Group:
Renovation of 9× 4000m³/h cooling towers to the CT Water Turbine

Shaanxi X Chemical Co., Ltd:
Renovation of 6× 4000m³/h cooling towers to the CT Water Turbine

Yip's Chemical Holdings Limited:
Renovation of 3× 2200m³/h cooling towers to the CT Water Turbine

Major Parts of CT Water Turbine



Summary (Product Advantages)

1. **Electricity Saving:** Originally installed motor for driving fan is eliminated, electricity saving rate is as high as 85%~100;
2. **Cost Saving:** As the maintenance and repairing time spent on motor, coupling and reducer are eliminated, the related fees are spared accordingly;
3. **Water Saving:** Fan speed, such as acceptable than the original slow (without affecting the process of the case), can reduce the evaporation of water;
4. **Lower Vibration/Noise:** Motor elimination can reduce vibration and noise;
5. **Smart Temperature Control:** Smart Temperature System may be used to keep water temperature stable in circulating water system.
6. **Environmental Protection:** Since electric motor and gearbox associated with motor transmission need lubricant for maintenance, which easily cause oil leakage and pollute environmental water, not only increasing water treatment fees, but also increasing other equipments' fault rate and lowering heat exchange efficiency.
7. **Safety:** CT Water Turbine works by using surplus water pressure rather than electricity and relevant devices, therefore eliminates risks caused by electricity leakage or sparkle in flammable and explosive area.

THE END

Thanks

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